HARDING RIVER CHINOOK SALMON BIOENHANCEMENT

PROGRESS REPORT - 1994

US/CANADA PACIFIC SALMON TREATY

COOPERATIVE AGREEMENT: NO. NA17FP006-04

PROJECT 2

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[1] The Regional Information Report Series was established in 1987 to provide an information access system for all unpublished divisional reports. These reports frequently serve diverse ad hoc informational purposes or archive basic uninterpreted data. To accommodate timely reporting of recently collected information, reports in this series undergo only limited internal review and may contain preliminary data, this information my be subsequently finalized and published in the formal literature. Consequently, these reports should not be cited without prior approval of the author or the Commercial Fisheries Division.

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INTRODUCTION

The Alaska Department of Fish and Game (ADF&G), Commercial Fisheries Management and Development Division (CFMDD) and the U. S. Forest Service (FS), Stikine Area, of the Tongass National Forest have been investigating the possibility of providing chinook salmon *Oncorhynchus tshawytscha* access to 9.75 km of stream above a partial barrier on the upper Harding River since the late 1970s. The mouth of the Harding River is located approximately 60 km southeast of the city of Wrangell in Southeast Alaska (Figure 1). Our objective was to determine if sufficient adult chinook salmon could be generated from the upper Harding River to warrant improved fish passage for adult chinook salmon. The barrier is a steep-walled canyon with 16-m of drop in approximately 305 m distance (Paul 1987) located 6.5 km above tide water (Figure 2). Only anadromous coho salmon *O. kisutch* are known to ascend the canyon.

ADF&G and FS fishery personnel initiated a plan to collect 50,000 chinook salmon eggs from native stocks below the canyon, incubate the eggs at ADF&G's Crystal Lake Hatchery (CLH) then adipose-clip (for a visual mark) and micro-coded-wire-tag (CWT) the fry before releasing them back into the upper Harding River. There were several questions we hoped to answer with this pilot project; could we obtain sufficient eggs from native stocks to support bioenhancement efforts; is stream habitat above the canyon suitable for rearing juvenile chinook salmon; would the adults be intercepted in local fisheries; and could adult spawners, imprinted as juveniles to the upper watershed, access the upper watershed without modifications to the canyon. Using FS grant money, we collected eggs in 1986 and 1989, releasing 30,500 and 31,200 fry above the canyon in 1987 and 1990 respectively (Figure 2).

ADF&G and FS personnel attempted to monitor the 1986-brood fry movement and growth in the Harding River the summer of 1987 and to collect smolt as they emigrated during the spring of 1988. Our sampling efforts provided little data. No marked juvenile chinook salmon were recaptured either above or below the canyon in 1987 and only 3 of 36 chinook salmon smolts examined in the spring of 1988 were adipose-clipped and coded-wire tagged. No funds were available to collect similar data on the 1989 brood releases.

ADF&G port samplers had better results during the 1989-1990 chinook fishing season, recovering 25 CTWs from our 1986-brood Harding River release, representing 46 fish harvested in Southeast Alaska commercial fisheries. This tag recovery information was sufficient to persuade ADF&G and FS staff that expanding chinook salmon access to the upper Harding River would generate additional fish for harvest in Southeast Alaska fisheries. The FS then concentrated on improving access, while ADF&G personnel developed a five-year plan for chinook salmon bioenhancement. Harding River chinook salmon bioenhancement was one of the projects selected to receive committed funding from the U. S./Canada Pacific Salmon Treaty for five years. This funding was originally granted to conduct chinook salmon egg takes on the Harding River from 1991 through the 1995 field season.

The Harding River chinook salmon bioenhancement plan followed the original study project, except the egg take objective was increased to 100,000 eggs with 50,000 fry CTWed. We also planned to collect additional smolt data on the planted stocks to compare with native chinook smolt. We expected the returning chinook salmon adults to take advantage of improved access through the canyon, compliments of FS modifications, staring a self-perpetuating run in previously inaccessible habitat. ADF&G and FS biologists estimate the stream habitat above the Harding River canyon could generate as many as 3,000 additional adult chinook salmon annually to the fisheries and escapement (Paul 1987).

The 1994 progress report will discuss egg-take activities and continued monitoring of harvest and escapement from previous enhancement efforts. Since this may be the final report of this series, I will provide summaries of chinook salmon egg-take operations and adult sampling from the project's inception. Previous unpublished reports describing 1986-1992 annual activities on Harding River chinook salmon enhancement are available through the ADF&G office in Petersburg or FS office in Wrangell, Alaska. Project activities for 1993 will be available as a CFMDD Regional Information Report (RIR).

MATERIALS AND METHODS

Camp and Access

A major flood during October 1993, made dramatic changes in the Harding River streambed, including the obliteration of our egg-take camp and adult capture site. I established a new camp 4.0 km above tide water or 1.0 km upstream of the original site. This camp consisted of a four-person mountain tent, placed on a 2.5 inch by 3.5-inch plywood platform elevated 2.0 m above the ground. This site was in a muskeg overlooking the river, well out of reach of even extreme high water. Modifications in the river channel caused by the flood made it impractical to navigate the river from camp to tide water with a jet powered skiff. Transportation to and from the site was by helicopter. A 16-foot welded aluminum skiff powered by a 40 horse power outboard with a jet unit was used for daily operations.

Smolt Emigration Study

I did not conduct smolt emigration studies on the Harding River in 1994. The 1992 brood spawn, that would have smolted in 1994, had to be destroyed when 4 of 12 chinook salmon brood females were found to be carriers of the Infectious Hematopoietic Necrosis (IHN) virus.

Egg-Take Operations

A field crew of two CFMDD personnel captured adult salmon with a 45 m (150 ft.) long, 3.0 m (10 ft.) deep gillnet with 20 cm (8 in.) stretch mesh. A 20-cm mesh net reduces incidental catches of non-target species, i.e., pink salmon *0. gorbuscha,* chum salmon 0. *keta,* and coho salmon. The crew secured the net in the eddy, spanning the entire width of the stream. Our primary fishing site was 300 m below the campsite. If fishing was slow, we would move operations up-stream to other eddies. When a fish hit the net, we pulled ourselves out on the cork-line, removed the fish from the net, and placed it in a dip net held over the side of the boat until the fish could be placed in a holding pen. We transported fish captured above the camp in a tote full of water set inside the boat.

The crew constructed two adult holding pen frames from 3.8-cm (1.5-in.) diameter aluminum tubing. These frames were 0.9 m (3 ft.) deep, 1.25 m (4 ft.) wide and 2.5 m (8 ft.) long, with a hinged lid. We covered the frames with vinyl coated wire mesh consisting of 5 cm (2 in.) square openings. We then attached six foam floats to each pen for buoyancy. The pens were attached to a pulley system in a back channel pool across from the primary adult capture site.

Field personnel kept a daily record of the chinook salmon catch by gender and whether or not a fish was adipose-clipped. I did not require catch records of non-target species, since most were spawned out chum and pink salmon carcasses drifting into the net. Since these numbers would fluctuate depending on water flows, there was little correlation between numbers of fish in the system and the number removed from the net.

Our Fish Transport Permit (FTP) allowed us to catch and retain a total of 15 unmarked chinook salmon females for spawning and sampling, plus hold enough males to provide at least a one male per one female fertilization rate. We could continue to capture males in order to obtain our female quota. We also retained any adipose-clipped chinook salmon for CWTs sampling. I decided not to utilize any of the adipose-clipped fish for spawning, since marked chinook salmon from non Harding River origin had been previously recovered in the river during 1989 and 1991 egg take operations.

Since the discovery of the IHN virus in the 1992 Harding River chinook salmon brood, no spawn could be removed from the Harding River drainage. We isolated the spawn in the Harding River by employing in-stream incubation technology. We located our in-stream incubation system on a spring 10 km above Fall Lake (Figure 2). Our only method of access to the in-stream incubation box was by helicopter. The location of the boxes precluded coded-wire tagging the fry as they volitionally left the incubation units. The 1993 progress report discusses potential smolt tagging options of enhanced fish in the Harding River.

Each Friday we would sort through the fish, females first, dispatching ripe fish with a blow to the head. We would place eggs in new self-sealing 7-L (2-gallon) plastic bags and milt into 0.2-L (6-oz) new self-sealing plastic bags. We did not need to sequentially number the spawn for "family tracking" as in previous years, which allows gametes from diseased parents to be discarded. Our single unit in-stream incubation system is not conducive for isolating individual sets of gametes. Our major concern was any presence of IHN virus, which would prohibit continued enhancement of the Harding River chinook stocks. Personnel placed the eggs and milt in coolers, covered all with a damp cloth and sprinkled with crushed ice, or inserted chemical cold packs on top of the spawn.

During the spawning process, we obtained a minimum of 5.0 ml of ovarian fluid from each female spawned for IHN. Kidney tissue samples were no longer required by the ADF&G pathology lab, from Harding River chinook salmon. The CWT Lab provided numbered cinch straps, which were secured to the heads of adipose-marked fish, plus data sheets to record pertinent data, i.e., mid-eye to fork length, date and location. I provided instructions to collect three scales and record mid-eye to fork length data, to the nearest 5 mm, by gender from each chinook salmon handled and to record whether each fish was used for spawning or not. Normally, I analyze scale patterns myself for age composition of fish sampled, this year Scott McPherson, Sport Fish Division (SF) in Douglas reviewed my interpretations.

In July ADF&G personnel installed a single-unit in-stream incubation box on the same spring as the original double unit that was washed out in the October 1993 flood. The single unit was 0.6 m (2 ft.) deep by 1.25-m (4-ft.) square. A 35 m, 5 cm diameter pipe delivered 20 lpm of water through the unit, capable of incubating 100,000 eggs.

At the incubation site, we would fertilize the eggs and milt in groups of two (at least two males per female) in a 8.0 L or larger plastic bucket. After fertilizing, we rinsed the eggs in spring water, and then water hardened the eggs in a 100-ppm iodophor solution. We then poured the eggs over the artificial substrate inside the incubation box and secured the lid. To keep from handling the eggs more than necessary, I estimated the number of eggs collected on fecundity rates by ocean age: 6,000 eggs for age .3 and 6,500 eggs for age's .4 and .5.

Adult Monitoring

In previous years ADF&G personnel traveled by boat and FS personnel by helicopter, in late August to early September, to observe chinook salmon activity in the canyon. We planned to expand our observations at the canyon in 1994 from late July through September, plus initiate an adult capture operation at the outlet of Fall Lake. In early August, ADF&G personnel stationed a 16-foot skiff with outboard, floating adult holding pen, and a gillnet, similar to the one used for brood stock capture, at the outlet of Fall Lake. Our intent was to fish the gillnet a least one day a week to verify if adult chinook salmon were getting above the barrier, and if these chinook salmon were from enhanced stocks. There had been no fish pass modification in the canyon. I knew we would be unable to obtain chinook salmon escapement counts by boat this year, due to changes in the river channel. ADF&G personnel conducted aerial surveys of Harding River to obtain chinook salmon escapement counts, time and weather permitting.

At the conclusion of the summer fishing season, I examined the ADF&G CWT Lab database in Juneau for any Harding River tag recoveries and "preliminary" in-season harvest estimates for the 1994 accounting year. The CWT Lab database operates on a calendar year basis. The chinook salmon commercial troll harvest (quota) year for Southeast Alaska runs from October of the previous calendar year through to September of the present calendar year. This necessitates combining CWT data from October through December 1993 with data collected from January to September 1994. The CWT Lab calculates harvest estimates from random tag recoveries in the various fisheries, based on tag to untagged ratios of the stock released and the sampling effort in the fishery in which the tag is recovered. Since some of the tags recovered are from select or non random samples, I interpreted each select tag as representing one fish in a fishery (troll, gillnet, seine, or sport), as long as no random tags were also recovered in that fishery, or the total number of tags recovered (regardless of sample type) was greater than the expansion estimate. I then summarize data from the 1994 fisheries with data from previous years to obtain a total picture of harvest and survival rates.

In 1993, the CWT Lab made minor adjustments in how contributions to the commercial fisheries, notably the troll fisheries, were calculated. Tag lab personnel recalculated estimated contributions to the fisheries back to 1986. Due to these changes, contributions by quota (harvest) year presented in Harding River chinook salmon progress reports prior to 1993 may be different from numbers reported in 1993 and later. Harvest numbers I report from the 1994 CWT database are preliminary and are subject to change.

RESULTS

Camp and Access

Our camp and riverboat were adequate for adult egg take operations. I was unable to obtain a FS Special Use Permit to build a permanent camp during the 1994 field season, though FS staff from Wrangell were very accommodating. The Harding River, being nominated for inclusion into Wild and Scenic River designation, made it a little more challenging to put in a permanent camp. The temporary camp was dismantled at the conclusion of the 1994 field season. Changes in the river channel prevented us from operating our boat from camp to tide water, but we had boat access from camp to the canyon.

Smolt emigration studies were not attempted in 1994.

Egg-Take Operations

ADF&G personnel captured 20 male and 8 female chinook salmon in the Harding River between August 16-31, 1994 (Table 1). None of the fish were marked (adipose-clipped). We conducted one spawn, involving a total of 7 females and 7 males, resulting in an estimated 45,000 eggs collected (Table 2). Only one female and one male died in our adult holding pens. Pathology Lab personnel detected no virus contamination from the ovarian fluid samples we collected (Appendix A).

We determined ocean age from 20 sets of the male scale samples: 1 (5%) were age .2; 10 (50%) were age .3; 8 (40%) were age .4; and 1 (5%) were age .5. Our ocean age analysis of seven sets of female scale samples was 2 (29%) were age .3; and 5 (71 %) were age .4. The mean lengths and range by ocean age and gender are shown in Table 3. We determined fresh-water age from 18 sets of scales from both genders; all were interpreted as smolting at age 1.

Adult Monitoring

FS personnel conducted at least one survey in the canyon in late July and personnel from both agencies visited the canyon at least once a week in August and several times thereafter in September and October. We observed at least one species of salmon at the base of the canyon during each trip. We counted a minimum of 6 adult chinook salmon in the canyon on August 5 and identified one adipose-clipped chinook salmon on August 10. We were unable to catch the marked fish for CWT sampling. We observed chinook salmon in the canyon on each survey in August. In addition, personnel counted as many as 150 pink salmon and 12 chum salmon at the base of the canyon during one of the visits, with coho present in increasing numbers throughout August and September. Our counts are only a reflection of species abundance. Turbulence in the canyon makes species identification and total abundance estimates difficult.

ADF&G personnel set the gillnet at the outlet of Fall Lake for 20 straight hours on August 3-4, without catching a fish. We set the gillnet again for several hours in mid-August to demonstrate the operation to FS staff, without catching a fish. Though we planned to set the gillnet at least one day a week at Fall Lake, circumstances prevented us from setting the net again this field season.

ADF&G staff, funded by Sport Fish (SF) Division chinook salmon research moneys, surveyed the Harding River for chinook salmon by helicopter on August 4 and 19. They counted 35 and 87 chinook salmon respectively on these dates. All these fish were seen at or below the canyon.

I reviewed the CWT lab database for CWTed Harding River chinook salmon recovered in the fisheries during the 1994 quota year. There were three tags listed (Appendix B). One tag from the 1989-brood release collected in the January-April portion of the winter troll fishery had an expansion estimate of 2 fish. The remaining 2 tags were from the 1991-brood release recovered in the seine fishery, representing a total of 2 fish. No tags from Harding River releases were found in the October-December 1993 calendar year portion of the 1994 quota year.

There was a second 1989-brood tag recovered in the October-December 1994 portion of the 1995 quota year, representing one fish. Normally, I would not present this data until the 1995 progress report, but this may be the last report written in this series, so I am including this data now. I can document a total return of 117 fish from the 1986-brood release and 4 fish from the 1989-brood release (Table 4). All CWT data after 1993 is preliminary and subject to change.

A summary of 117 Harding River 1986-brood chinook salmon harvested from 1989 through 1993, by gear group, shows; 90 (80%) fish were taken by the troll fleet, 12 (11%) fish in the gillnet fisheries, 8 (7%) to the sport fisheries, and 3 (3%) to the seine fisheries (Table 5). Three (75%) chinook salmon harvested from the 1989-brood release were taken in the troll fishery and a single (25%) fish was harvested in the seine fishery (Table 5).

The southeast Alaskan troll fishery CWT expansions are reported in the CWT database by quadrant by fishing period. The Harding River is located at the center of the southeast (SE) quadrant (Figure 1). The other three quadrants are southwest (SW), northeast (NE), and northwest (NW). The estimated Harding River 1986-brood chinook salmon distribution in the troll fishery is: 42 (47%) to the SE quadrant, 29 (32%) to the NE quadrant, 16 (18%) to the NW quadrant, and 3 (3%) to the SW quadrant (Table 6). All three of the troll caught 1991 brood release came from the NE quadrant (Table 6).

ADF&G currently recognizes three common property troll harvest periods in a quota (harvest) year; the winter - early October through April 14, spring - experimental and/or hatchery access fisheries in May and June, and summer fisheries - July 1 until the quota is harvested (Chinook Salmon Planning Team. 1992).[2] The winter fishery data can be divided into two segments, October - December and January - April. I will treat these segments as one fishing period in this report. A summary of troll harvest by harvest period shows, of the 90 Harding River 1986-brood chinook salmon caught, 40 (44%) of the fish were taken in the spring fisheries, while 26 (29%) and 24 (27%) of the fish were harvested in the winter and summer fisheries respectively (Table 7). All 3 fish caught by the troll fleet were taken in the winter fisheries (Table 7).

[2] After the 1992-harvest year, the starting date of the winter troll fishery was changed from October 1 to October 11 with a maximum harvest goal of 45,000 chinook salmon, also the hatchery access troll fisheries were eliminated.

DISCUSSION

Camp and Access

The new campsite is safer for the crew from floodwaters, and there is an adequate location to beach the boat. My only concerns about the adult holding pens location are, they are across the river and not visible from camp, making it difficult to react to emergency situations.

Smolt Emigration Studies

Though we did not conduct smolt emigration studies in 1994, 1 would recommend anyone interested in smolt operations in the Harding River to review the 1993 progress report.

Egg-Take Operations

Our 20 cm mesh gillnet continues to be a practical method to capture adult chinook salmon brood stock in the Harding River. The 28 adult chinook salmon we caught were the lowest number handled over the course of this project (Table 8). Fishing a new site and low escapement are likely the causes of reduced catches. The incidental catch of non-target species is virtually nil, despite thousands of pinks and hundreds of coho and chum salmon migrating past the net.

Most Harding River chinook salmon females we handle are not ready to spawn until mid-August to early September (Table 9). 1 would not recommend collecting chinook salmon adults before mid-August since this would result in greater catches of the physically large race of chum salmon that spawn in the Harding River. Fortunately these chum have a peak spawning period of mid to late July. Also, catching chinook salmon earlier could result in increased holding mortality.

Although the gillnet has the capability to inflict severe injury to adult chinook salmon, it appears that most mortality is induced by abrasion of the fish on the mesh of smaller holding pens. The new pens we built in 1994, for holding adult chinook salmon, were 1.25 m wide compared to 0.9 m wide for older pens. This additional width seemed to reduce abrasion and mortality of fish being held. Though the aluminum frame pens are more expensive than building with wood, I prefer the aluminum pens. They are easier to handle and hold up better under field conditions.

I inspected the in-stream incubation box with an assistant on October 5 and again with FS staff on December 8. During the first inspection we removed the lid and found the eggs weakly eyed, estimating survival to be 90% or higher. On the second visit, we found the box covered with an estimated 1.5 meters of snow, but the spring was ice free and water flow through the box remained similar to original flows.

We did not remove the lid on the second trip. ADF&G Pathology Lab personnel detected no IHN virus in the 1994 ovarian fluid samples: incubation was allowed to continue.

I consolidated Harding River chinook salmon mid-eye to fork length data collected during the project (excludes 1986) for future reference (Table 10). These data can be used to compare Harding River chinook salmon stock to other chinook stocks. If chinook salmon access to the upper Harding River is finally achieved, this data can ascertain whether access is selective to certain age classes or size of returning adults. These data need to be viewed with the knowledge that the gillnets we use are biased towards larger, older age class fish.

Adult Monitoring

We discovered two major differences in salmon activities in the Harding River canyon during 1994. We observed significant numbers of pink, chum, and chinook salmon at the base of the canyon, where few or none had previously been seen, and the canyon became a total barrier to coho salmon adult migration. Neither ADF&G nor FS personnel observed coho salmon in the upper Harding River in 1994. FS staff plan to sample the upper Harding River the summer of 1995 for coho salmon fry in order to verify whether adults spawned above the canyon the fall of 1994.

It was very apparent to us that significant physical changes occurred in the canyon between the fall of 1993 and the 1994 field season. Even the large rock, that was the focus of improving fish access, appeared to have shifted within the canyon making it less of an obstacle for fish. Unfortunately, other hydraulic changes caused a total blockage to fish migration. We believe the heavy rains during October 25-26, 1993 contributed to the hydraulic changes seen in the canyon and elsewhere in the Harding River.

Hydraulic changes to the Harding River canyon made ADF&G and FS personnel redefine our project priorities. Though our ultimate objective is to develop a chinook salmon run to the upper Harding River, we believe the immediate objective is to re-establish coho access to the upper river. Chinook salmon bioenhancement will be halted so both agencies can concentrate their efforts to improving fish access. If access can be restored within two years, it would benefit the native coho salmon run and still take advantage of 1991 and later chinook salmon bioenhancement efforts.

It is difficult for us to make accurate counts of chinook salmon on the Harding River; the river is semi-glacial making visibility difficult at times. Peak numbers of chinook salmon observed by biologists in 1994 was 87 fish on August 19. Biologists conducted this survey by helicopter. Our brood stock capture of 28 chinook salmon was over a nine day period.

Our brood stock capture technique usually provides the peak count of chinook salmon in the Harding River during years it is in operation (Table 11). Most chinook salmon surveys on the Harding River are conducted by biologists in fixed-wing aircraft, which are normally in conjunction with chum or pink salmon surveys. Few of these surveys are flown during the peak of chinook salmon spawning activities in the Harding River. Anyone reviewing chinook salmon escapement records from the Harding River must be cautious when comparing counts recorded using one technique with another, or during different dates on different years. If possible, chinook salmon surveys on the Harding River should be conducted from a helicopter during the last two weeks of August.

The CWT data suggests the Harding River 1986-brood release of 30,500 fry contributed up to 113 fish to southeast fisheries. It is not surprising only four tags were recovered in the escapement since we are likely capturing only a small portion of the actual chinook salmon run in the Harding River each year. The Chinook Salmon Planning Team (1991) investigations demonstrate harvest rates of southeast Alaska chinook salmon stocks are less than 50% of the actual production, indicating the total return from the 1986-brood release was likely greater than 200 fish. The 1986-brood smolt and adult sampling data suggests habitat below the barrier on the Harding River could produce 2,500 or more chinook salmon naturally from a single brood experiencing good survival rates throughout its life cycle. This supports the estimated 3,000 chinook salmon biologists believe could be generated from enhancing the upper Harding River.

The lack of Harding River 1989-brood seems to follow a trend of low smolt to adult survival rates similar to what I have observed from the same brood year at CLH. We did not have funds to study the 1989-brood smolt outmigration in 1991.

Sport harvest during 1990 and 1991 was likely greater than the tag recoveries indicate. Creel surveys during these years were centered around the cities of Juneau and Ketchikan (Paul Suchanek, personal communication). Sport Fish personnel did not conduct on-site creel surveys in Petersburg or Wrangell in 1990 and only the derbies in these communities were surveyed in 1991, though harvest trends in these communities have steadily increased more than in Juneau and Ketchikan (Paul Suchanek, personal communication). The majority of tagged Harding River chinook salmon harvested in the commercial troll fisheries occurred in the Petersburg and Wrangell areas. Estimated Southeast Alaskan sport harvests have increased from 30,000 chinook salmon in 1989 to as high as a projected 70,000 for 1991 (Paul Suchanek, personal communication).

The distribution and timing of Harding River chinook salmon interceptions in Southeast Alaskan fisheries underscores the potential benefit of expanding this stock to the upper river. These fish have a strong tendency to feed and mature in Southeast Alaskan in-side waters throughout the year. This pattern makes them available for harvest by local fisheries, which is the basic reason to enhance this stock.

LITERATURE CITED

Chinook Salmon Planning Team. 1991. Chinook salmon plan for southeast Alaska, 1991 annex. Alaska Department of Fish and Game. Juneau, Alaska.

Meyers, T. 1993. Report of laboratory examination. Accession No.: 93-0510. Alaska Department of Fish and Game. Juneau, Alaska.

Paul, L. et. al. 1987. Harding River fishy value analysis. Department of Agriculture. Tongass National Forest. Stikine Area. Juneau, Alaska.

Table 1. Summary of chinook salmon brood stock collection, Harding River, 1994.

	Males		Females		Totals	
Date	Marked	Unmarked	Marked	Unmarked	Marked	Unmarked
Aug 16	0	4	0	5	0	9
17	0	1	0	0	0	1
18	0	4	0	1	0	5
19	0	1	0	0	0	1
20	Weekend - returned to Petersburg					
21	Weekend - returned to Petersburg					
22	High Water Could Not Fish					
23	High Water Could Not Fish					
24	0	0	0	1	0	1
25	0	1	0	1	0	2
26	Spawned - 7 females : 7 males					
27	Weekend - returned to Petersburg					
28	Weekend - returned to Petersburg					
29	0	2	0	0	0	2
30	0	3	0	0	0	3
31	0	4	0	0	0	4
Sept 1	No ripe females to spawn - prepared to close camp					0
2	Closed Camp					
Totals	0	20 a/	0	8 b/	0	28

a/ Spawned 7; released 12; holding mortalities 1;
b/ Spawned 7; 1 holding mortality.

Table 2. Summary of chinook salmon spawning, Harding River, 1994.

Date		# Males	# Females	# Eggs	
August	26	7	7	45,000	a/
Totals		7	7	45,000	

a/ Estimated number of eggs taken; using 6,000 eggs for age .4 ocean females and 6,500 eggs for age .4 ocean females spawned.

Table 3. Length data (mid-eye to fork length to nearest 5 mm) of unmarked chinook salmon sampled in the escapement, by gender and ocean age, Harding River, 1994.[a]

	Ocean	Mid-Eye to Fork Length			
Gender	Age b/	Mean	Range	S.D.	n
Male	2	590	590	...	1
	3	760	695-890	65	10
	4	865	775-990	75	8
	5	960	960	...	1
Female	3	770	770-810	30	2
	4	890	860-975	45	5

a/ Fish were collected using a gillnet with 20 cm stretch mesh.
b/ Freshwater growth patterns were discernible on 18 scales: all were interpreted as smolting as age 1.

Table 4. Summary of enhanced Harding River chinook salmon fry releases and documented returns, 1989-1994.

Brood Stock Year	Date Released	Release Size (gms)	Tag Code	Number Tagged	Total Release	Quota Year	Commercial Catch a/	Sport Catch	Escape-ment b/	Total Return	% Return
Harding R. 1986	05/19/87	0.9	B3-05-13	11,778	12,043	1989	6	0	1	7	0.02%
			B3-06-08	11,277	11,531	1990	46	2	0	48	0.16%
			B4-13-12	6,796	6,949	1991	50	6	3	59	0.19%
			Totals	29,851	30,523	1992	3	0	0	3	0.01%
						1993	0	0	0	0	0.00%
						Totals	105	8	4	117	0.38%
Harding R. 1989	06/13/90	1.0	0401011005	11,319	11,890	1992	1	0	0	1	0.00%
			0401011006	11,275	11,844	1993	0	0	0	0	0.00%
			0401011007	7,115	7,474	1994	2	0	c/	2	0.01%
			Totals	29,709	31,208	1995	1 d/	...	...	1	0.00%
						1996	...	...	...	0	0.00%
						Totals	4	0	0	4	0.01%
Harding R. 1991	07/08/92	1.5	0401011510	33,850	41,800	1994	2	0	0	2	0.01%
						1995	...	...	...	0	0.00%
						1996	...	...	...	0	0.00%
						1997	...	...	...	0	0.00%
						1998	...	...	...	0	0.00%
						Totals	2	0	0	2	0.01%
Harding R. 1992	Approximately 68,500 alevins were destroyed when 4 brood females tested positive for IHNV.										
Harding R. 1993	Approximately 57,500 eggs were lost when the incubation boxes were destroyed by a flood.										

a/ Data for 1994 are very preliminary in-season estimates.
b/ Escapement estimates are from CWTs recovered during egg takes.
c/ At least one adipose-clipped chinook salmon was observed in the escapement, but not recovered for CWT sampling.
d/ One tag was recovered during Oct-Dec 1994 winter fishery which is part of the 1995 quota year. This fishery is still in progress as of this writing.

Table 5. Summary of enhanced Harding River chinook salmon harvest by brood year, harvest year, and gear group, 1989-1994.

Brood Year	Harvest Year	Gear Group				Total Harvest
		Sport	Gillnet	Seine	Troll	
1986	1989	0	4	2	0	6
	1990	2	5	0	41	48
	1991	6	3	1	46	56
	1992	0	0	0	3	3
	1993	0	0	0	0	0
Totals		8	12	3	90	113
% Harvest		7%	11%	3%	80%	100%
1989	1992	0	0	1	0	1
	1993	0	0	0	0	0
	1994 a/	0	0	0	2	2
	1995 b/	...	...	...	1	1
	1996	...	...	...	...	...
Totals		0	0	1	3	4
% Harvest		0%	0%	25%	75%	100%

a/ Data for 1994 are very preliminary in-season estimates.
b/ One tag was recovered during the Oct-Dec 1994 winter fishery (1995 harvest year). This fishery is still in progress as of this writing.

Table 6. Summary of enhanced Harding River chinook salmon troll harvest by brood year, harvest year and quadrant, 1989-1994.

Brood Year	Harvest Year	Quadrant SW	SE	NE	NW	Totals
1986	1989	0	0	0	0	0
	1990	3	26	7	5	41
	1991	0	16	20	10	46
	1992	0	0	2	1	3
	1993	0	0	0	0	0
Totals		3	42	29	16	90
% Harvested		3%	47%	32%	18%	100%
1989	1992	0	0	0	0	0
	1993	0	0	0	0	0
	1994 a/	0	0	2	0	2
	1995 b/	0	0	1	0	1
	1996	...	...	...	...	...
Totals		0	0	3	0	3
% Harvested		0%	0%	100%	0%	100%

a/ Data for 1994 are very preliminary in-season estimates.

b/ One tag was recovered during the Oct-Dec 1994 winter fishery (1995 harvest year). This fishery is still in progress as of this writing.

Table 7. Summary of enhanced Harding River chinook salmon in the commercial troll fishery by brood year and harvest period, 1989-1994.

Brood Year	Harvest Year	Troll Periods			
		Winter	Spring	Summer	Totals
1986	1989	0	0	0	0
	1990	0	23	18	41
	1991	23	17	6	46
	1992	3	0	0	3
	1993	0	0	0	0
Totals		26	40	24	90
% Harvested		29%	44%	27%	100%
1989	1992	0	0	0	0
	1993	0	0	0	0
	1994 a/	2	0	0	2
	1995 b/	1	...	...	1
	1996	...	...	...	...
Totals		3	0	0	3
% Harvested		100%	0%	0%	100%

a/ Data for 1994 are very preliminary in-season estimates.

b/ One tag was recovered during the Oct-Dec 1994 winter fishery (1995 harvest year). This fishery is still in progress as of this writing.

Table 8. Summary of chinook salmon brood stock capture by gender, using a 20mm stretch mesh gillnet, Harding River, 1986, 1989, and 1991-1994.

Year	Catch by Gender		Total Catch
	Males	Females	
1986	56	34	90
1989 a/	52	33	85
1991 b/	28	13	41
1992	28	15	43
1993	67	12	79
1994	20	8	28
Totals	251	115	366

a/ Includes 2 adipose-clipped males: one from the Harding River 1986-brood release and one stray from Earl West Cove. Brood stock was taken for Burnett Inlet Hatchery in addition to Harding River enhancement.

b/ Includes 5 adipose clipped males: 3 from the Harding River 1986-brood release; one stray from Little Port Walter, and one no tag.

Table 9. Summary of chinook salmon spawning, Harding River , 1986, 1989, and 1991-1994.

Year	Spawning Dates	Males	Females	Number of Eggs		Fecundity	
1986	Aug 21-27	16	10	47,600	a/	4,800	a/
1989	Aug 16-26	18	18	111,000	a/ b/	6,200	a/
1991	Sept 6	8	8	57,700	a/	7,200	a/
1992	Aug 26-Sept 1	12	12	77,500	a/	6,500	a/
1993	Aug 20-Sept 3	12	9	57,500	c/		
1994	Aug 26	7	7	45,000	c/		

a/ Based on actual counts recorded at hatcheries, rounded to nearest 100 eggs.

b/ Eggs were collected for Burnett Inlet Hatchery as well as Harding River enhancement.

c/ Estimated numbers of eggs placed in in-stream incubators, estimating 6,000 eggs per age .3 ocean females and 6,500 eggs for age .4 ocean females spawned.

Table 10. Summary of chinook salmon length data (mid-eye to fork length to nearest 5 mm) sampled in the escapement, by gender and ocean age, Harding River, 1989 and 1991-1994.

Gender	Ocean Age b/	Mid-Eye to Fork Length			
		Mean	Range	S.D.	n
Male	2	605	520-680	40	16
	3	745	590-910	65	80
	4	920	700-1,050	85	59
	5	930	900-960	40	2
Female	3	830	765-950	50	23
	4	895	780-980	50	45
	5	895	895	-	1

a/ Fish were collected using a gillnet with 20 cm stretch mesh.
b/ Freshwater growth patterns were discernible on 168 scales: 164 were interpreted as smolting as age 1. and 4 as age 2.

Table 11. Summary of chinook salmon brood stock captured for egg takes, compared to peak aerial and peak escapement surveys, Harding River, 1986, 1989, and 1991-1994.

Year	Brood Stock Captured	Peak Aerial Counts a/	Peak Survey Counts-Methods
1986	90	41	240 - egg take/boat
1989	85	80	85 - egg take
1991	41	0	42 - egg take/foot
1992	43	48	48 - aerial
1993	79	40	79 - egg take
1994	28	23	87 - helicopter
	366	232	581

a/ Surveys conducted from fixed-wing aircraft.

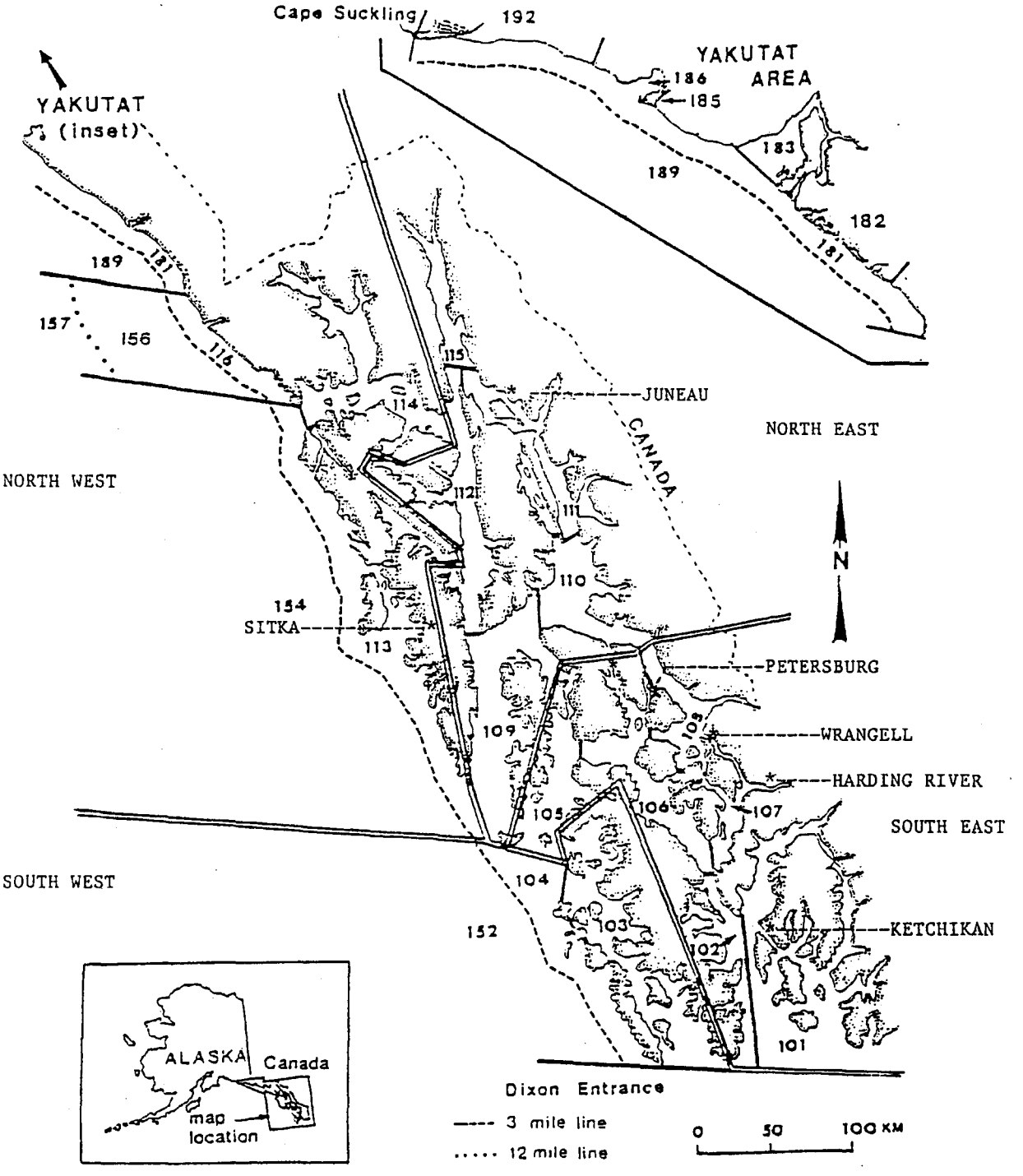

Figure 1. Geographic location of the Harding River and designated commercial fishing districts and troll quadrants, Southeast Alaska.

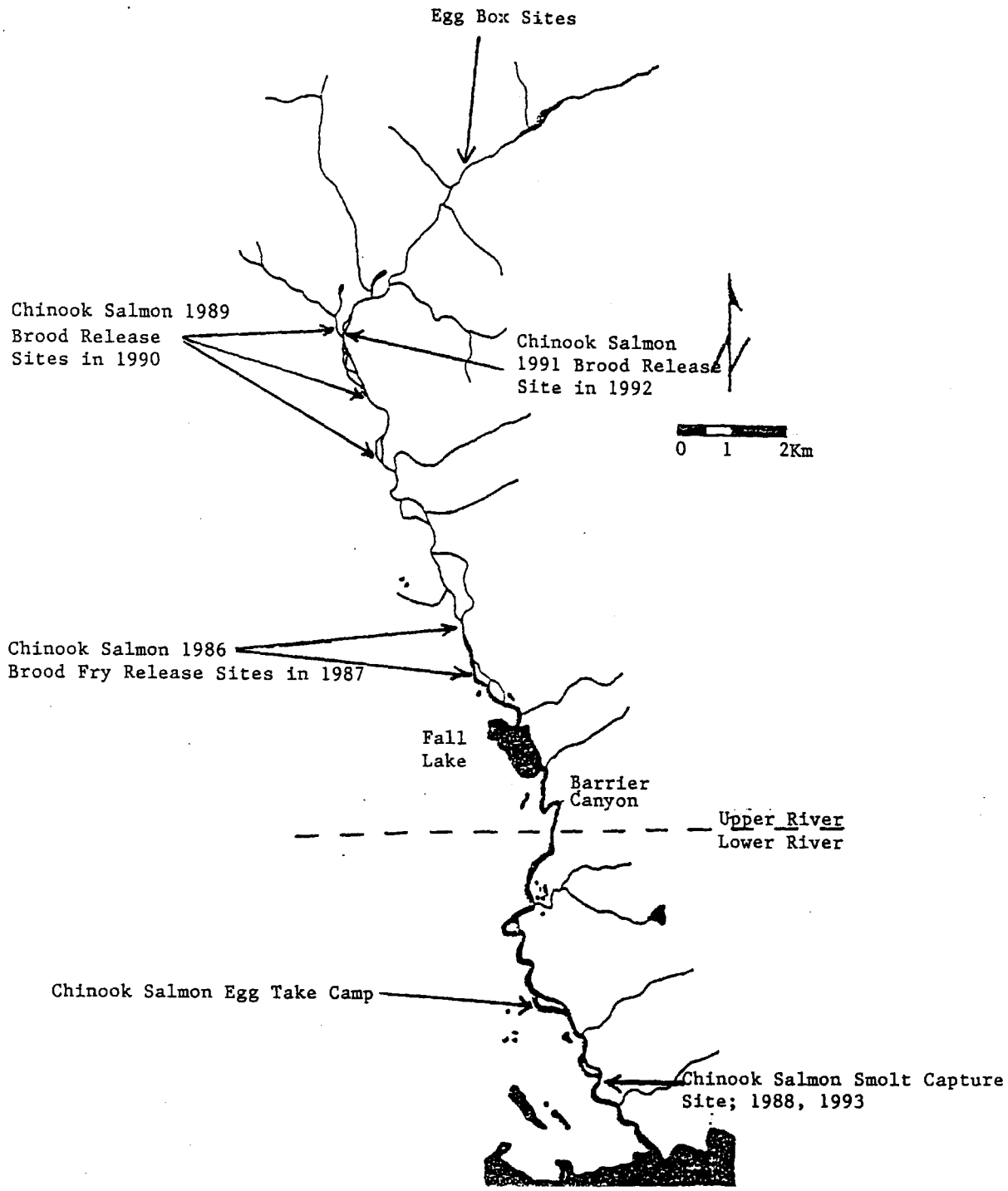

Figure 2. Chinook salmon project sites and barrier canyon location on Harding River, Southeast Alaska.

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